Format for Incorporating Short and Long-Term Intent Information

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Intent Subgroup of WG4

- Intent subgroup of RTCA SC-186, WG4 is looking into ADS-B intent issues:
  - Information content.
  - Data format.
  - Information validity.
- Intent information can be categorized into:
  - Short-term intent - MCP selected heading/track, altitude, vertical rate, IAS/Mach.
  - Long-term intent - location and altitude of FMS-derived TCP's (waypoints, T/C, T/D, Mach/CAS, etc.)
- Knowledge of each type of intent is important in being able to reconstruct an aircraft's intended path.

Integration of Short and Long-term Intent

- Intent subgroup is focusing on ways to incorporate short and long-term intent into ADS-B message.
- Our approach presented at January Ad-Hoc MASPS meeting.
- Discussions within intent subgroup and comments received from last presentation suggest 2 approaches to providing short and long-term intent.
  - 1) Integrate short-term and long-term intent into TCP's.
    - Represents "command trajectory" (actual aircraft trajectory if pilot pushes no more buttons).
  - 2) Send MCP and FMS intent parameters separately, along with current flight mode, and let receiving aircraft reconstruct the path.

Method (1) - Integration of Short-term and Long-term Intent into TCP's

- Trajectory generation done mainly on transmit side.
  - Requires fewer parameters to be sent.
  - Less chance that receiving aircraft misinterprets information.
- Appears to be approach suggested by current ADS-B MASPS.
  - "The TCP from the transmitting aircraft is the point in three dimensional space where the current operational trajectory is planned to change, and estimated remaining flight time to that point." - p. 39
  - "[TCP's] are not necessarily RNAV flight plan waypoints." - p. 41

Method (1) (cont.)

- Requires complex trajectory builder on transmitting aircraft that must be capable of generating TCP's from both MCP and FMS parameters, such as:
  - Turn to heading to intercept LNAV path.
  - Intermediate level-off in VNAV descent.
  - Mixed FMS/MCP modes cause additional complexity.
    - LNAV/Vertical Speed (VNAV altitudes no longer active).
    - Heading Hold/VNAV (LNAV waypoints no longer active).
- Airbus appears to favor this approach.
  - Study proposes an architecture that considers flight mode logic, FMS, and Flight Control Unit (FCU) altitudes to produce a single target altitude.
- Concern that complexity on transmit side will lead to fewer aircraft being equipped to send intent information.

Method (2) - Separate Broadcast of MCP and FMS Intent Parameters

- Trajectory generation done mainly on receive side.
- Transmitting aircraft provides MCP and FMS parameters, along with current flight mode.
- Requires complex trajectory builder on receiving aircraft that must be capable of determining which intent parameters to use when constructing transmitting aircraft's path.

Method (2) (cont.)

- Offers some potential advantages over Method (1).
  - Receiving aircraft has knowledge of “command” and “planned” trajectories.
    - Command trajectory represents current automation state.
    - Planned trajectory represents longer term intent (such as bottom of descent altitude if MCP selected altitude set to intermediate level-off.
  - Less complexity on transmit side could lead to earlier and more universal equipage.
  - Receive side trajectory generator could be designed to meet specific application requirements.
- Concerns raised about number of parameters needed in ADS-B message, complexity, potential ambiguities that must be resolved by receiving aircraft.

Possible Combined Approach

- Method (1) [creating TCP's on transmit side] appears to be favored by current MASPS.
  - Clearer picture of intended trajectory provided to receiving aircraft.
  - May be limiting to lesser equipped aircraft that cannot generate TCP's as currently defined in MASPS.
- Suggestion to send TCP's according to transmitting aircraft's capability.
  - Aircraft capable of rolling short-term and long-term intent into a TCP represent a higher level of equipage.
  - Some aircraft may only be able to send FMS-generated TCP's.
    - Should be augmented with MCP selected altitude.
    - Additional field should clarify what is provided in TCP.

Direction of WG4 Intent Sub-group

- Would like to achieve consensus on approach to sending ADS-B intent information that should be pursued by Intent Subgroup.
  - Will allow more detailed implementation work.
  - Will support MASPS clarification of TCP definitions.